

## CLAIMS

1. A honeycomb type solid-oxide fuel cell formed of any of a solid-oxide material, a fuel pole material and an air pole material and having a honeycomb structural body  
5 comprising rectangular cells in cross section, wherein cells adjacent to wall surfaces constituting a fuel pole cell of the fuel cell function as air pole cells and cells adjacent to the corners of wall surfaces of the fuel pole cell and adjacent to wall surfaces of an air  
10 pole cell function as cooling air cells, whereby fuel pole cells, air pole cells and cooling air cells are arranged in longitudinal and lateral directions so that cells of the same type appear in every other location.
2. A honeycomb type solid-oxide fuel cell having fuel  
15 pole cells, air pole cells and cooling air cells which form a honeycomb structural body comprising square cells in cross section, said honeycomb structural body being made of any of a solid-oxide material, a fuel pole material and an air pole material, wherein a fuel cell  
20 group is formed by stacking at least two honeycomb type fuel cells in each of which cells adjacent to wall surfaces constituting a fuel pole cell of the fuel cell function as air pole cells and cells adjacent to the corners of wall surfaces of the fuel pole cell and  
25 adjacent to wall surfaces of an air pole cell function as cooling air cells, whereby fuel pole cells, air pole cells and cooling air cells are arranged in longitudinal

and lateral directions so that cells of the same type appear in every other location, and fuel poles and air poles of the mutually adjacent honeycomb type fuel cells are connected with inter-connectors to form a series

5 connection so that an electric power is taken by collectors provided at both ends of said group of the fuel cells.

3. The honeycomb type solid-oxide fuel cell according to Claim 1 or 2, wherein the honeycomb structural body is  
10 made of a solid-oxide material, the fuel pole cells are formed by providing a fuel pole on the inner surfaces of cells of the honeycomb structural body and the air pole cells are formed by providing an air pole on the inner surfaces of the cells which are adjacent to the wall  
15 surfaces of the fuel pole cells.

4. The honeycomb type solid-oxide fuel cell according to Claim 1, 2 or 3, wherein the cells have the same square shape in cross section.

5. The honeycomb type solid-oxide fuel cell according to  
20 Claim 1, 2 or 3, wherein the fuel pole cells have a square shape in cross section, the air pole cells have a rectangular shape in cross section and have a wall surface of the fuel pole cell as a longer side, and the cooling air cells have a square shape in cross section  
25 and have a shorter side of the air pole cells as a side, or have a circular shape the diameter of which is the same as the shorter side of the air pole cells.

6. The honeycomb type solid-oxide fuel cell according to any one of claims 1 to 5, wherein a part or the entirety of the wall surfaces of the fuel pole cells, the air pole cells and the cooling air cells each having a rectangular shape in cross section is curved or corrugated.

7. The honeycomb type solid-oxide fuel cell according to any one of Claims 2 to 6, wherein a first collector provided with fuel cell closing surfaces and flow passages for the air pole cells and the cooling air cells is connected to an end of the honeycomb type fuel cell located at an end of the fuel cell group, and an air inlet/outlet unit in which cooling air conduits are inserted is connected to the first collector;

a second collector in which flow passages for the fuel pole cells, flow passages for the air pole cells and flow passages for the cooling air cells are formed is connected to an end of the honeycomb type fuel cell located at the other end of the fuel cell group; an air reversing chamber and an exhaust fuel collecting chamber through which fuel supply pipes are penetrated are connected sequentially to the second collector, and a fuel supply header for supplying fuel is connected to the exhaust fuel collecting chamber, and,

the fuel supply pipes which extend from an end of the exhaust fuel collecting chamber through the air reversing chamber and the second collector to the vicinity of the air inlet/outlet-side surface of the fuel

pole cells are inserted into the fuel pole cells with gaps to the inner surfaces of the cells.

8. The honeycomb type solid-oxide fuel cell according to any one of Claims 1 to 7, wherein the direction of air  
5 flowing in the cooling air cells is made opposite to the direction of reacting air flowing in the air pole cells to form a counter flow.

9. The honeycomb type solid-oxide fuel cell according to Claim 7 or 8, wherein a plurality of functional parts of  
10 the constituent members comprising the honeycomb type fuel cells, the first collector, the second collector, the air reversing chamber, the exhaust fuel collecting chamber and the fuel supply pipes which constitute the honeycomb type solid-oxide fuel cell, are formed  
15 integrally or connected integrally.

10. The honeycomb type solid-oxide fuel cell according to Claim 7, wherein a fuel reforming catalyst is filled in the fuel supply pipes for the reformulation of the fuel in the fuel supply pipes.

20 11. The honeycomb type solid-oxide fuel cell according to any one of Claims 1 to 10 wherein the solid electrolyte is yttria-stabilized zirconia (YSZ), scandium-stabilized zirconia (ScSZ), a lanthanum gallate type solid electrolyte (LSGM, LSGMC), or a solid electrolyte of,  
25 e.g.  $\text{Cl}_2\text{A}_7(12\text{CaO} \cdot 7\text{Al}_2\text{O}_3)$  having  $\text{O}^-$  or  $\text{O}^{2-}$ -ion conductive properties or a solid electrolyte having  $\text{H}^+$  or  $\text{H}^-$ -ion conductive properties.

12. The honeycomb type solid-oxide fuel cell according to Claim 11, wherein the lanthanum gallate type solid-oxide is  $\text{La}_{0.8}\text{Sr}_{0.2}\text{Ga}_{0.8}\text{Mg}_{0.2}\text{O}_x$ ,  $\text{La}_{0.9}\text{Sr}_{0.1}\text{Ga}_{0.8}\text{Mg}_{0.2}\text{O}_x$ ,  $\text{La}_{0.8}\text{Sr}_{0.2}\text{Ga}_{0.8}\text{Mg}_{0.15}\text{Co}_{0.05}\text{O}_x$  or  $\text{La}_{0.9}\text{Sr}_{0.1}\text{Ga}_{0.8}\text{Mg}_{0.15}\text{Co}_{0.05}\text{O}_x$ .